Claims

1. A nitride semiconductor light emitting device comprising:

an n-type nitride semiconductor layer;

an In-containing super lattice structure layer formed above the n-type nitride semiconductor layer;

a first electrode contact layer formed above the super lattice structure layer;

a first cluster layer formed above the first electrode contact layer;

a first In-containing nitride gallium layer formed above the first cluster layer;

a second cluster layer formed above the first In-containing nitride gallium layer;

an active layer formed above the second cluster layer;

a p-type nitride semiconductor layer formed above the active layer; and

a second electrode contact layer formed above the p-type nitride semiconductor layer.

2. The device according to claim 1, wherein the active layer comprises:

a first quantum well layer having an $In_yGa_{1-y}N$ well layer/$In_zGa_{1-z}N$ barrier layer structure;

a second In-containing nitride gallium layer formed above the first quantum well layer; and

a second quantum well layer formed above the second In-containing nitride gallium layer to have an $In_yGa_{1-y}N$ well layer/$In_zGa_{1-z}N$ barrier layer structure.

3. The device according to claim 1, further comprising a buffer layer formed down the n-type nitride semiconductor layer, and a substrate formed down the buffer layer.

4. The device according to claim 1, wherein the n-type

nitride semiconductor layer is doped with indium (In).

5. The device according to claim 3, wherein the buffer layer has one selected from an AlInN structure, an AlInN/GaN layered structure, an InGaN/GaN super lattice structure, an $In_xGa_{1-x}N$/GaN layered structure, and an $Al_xIn_yGa_{1-x-y}N/In_zGa_{1-z}N$/GaN layered structure.

6. The device according to claim 1, wherein the first electrode contact layer is a Si-In co-doped nitride gallium layer.

7. The device according to claim 1, wherein the first cluster layer and/or the second cluster layer are formed to have a thickness of atomic scale.

8. The device according to claim 1, wherein the cluster layers are formed of SiN_a.

9. The device according to claim 1, wherein the first In-containing nitride gallium layer has a surface shape grown in a spiral mode.

10. The device according to claim 1, wherein the first In-containing nitride gallium layer has a surface shape grown and connected up to a surface of the active layer.

11. The device according to claim 1, wherein the active layer has a single quantum well structure or a multi quantum well structure, which is has an $In_xGa_{1-x}N$ well layer/$In_yGa_{1-y}N$ barrier layer.

12. The device according to claim 11, wherein the InxGa1-xN well layer/InyGa1-yN barrier layer have indium contents of $0<x<0.35$ and $0<y<0.1$, respectively.

13. The device according to claim 1, wherein the first In-containing nitride gallium layer is expressed as $In_xGa_{1-x}N$, and has a value of $1<x<0.1$.

14. The device according to claim 11, further comprising a SiN_a cluster layer formed between the $In_xGa_{1-x}N$ well layer and the $In_yGa_{1-y}N$ barrier layer of the active layer to have a thickness of atomic scale.

15. The device according to claim 1, further comprising a SiN_a cluster layer formed between the active layer and the p-nitride semiconductor layer to have a thickness of atomic scale.

16. The device according to claim 1, wherein the second electrode contact layer is formed to have one selected from an $In_xGa_{1-x}N/In_yGa_{1-y}N$ super lattice structure, an $In_xGa_{1-x}N$ super grading structure and ($In_xGa_{1-x}N/In_yGa_{1-y}N$ super lattice)/n-GaN layered structure.

17. The device according to claim 1, wherein $In_xGa_{1-x}N/In_yGa_{1-y}N$ layers of the second electrode contact layer have a thickness of 2-50Å, respectively and alternately.

18. The device according to claim 14, wherein the $In_xGa_{1-x}N/In_yGa_{1-y}N$ layers of the second electrode contact layer have a total thickness of less than 200Å.

19. The device according to claim 1, wherein the second electrode contact layer has a doped silicon.

20. The device according to claim 1, wherein the n-type nitride semiconductor layer and the In-containing super lattice structure formed above the n-type nitride semiconductor layer is repeatedly formed.

21. The device according to claim 1, wherein the In-containing super lattice structure layer formed of $In_xGa_{1-x}N/In_yGa_{1-y}N$ is provided at least one.

22. The device according to claim 1, wherein the p-type nitride semiconductor layer is formed to have a multi-layered structure in which a doped amount of magnesium is sequentially increased.

23. The device according to claim 2, wherein the second In-containing nitride gallium layer has a chemical formula of $In_xGa_{1-x}N$ ($0<x<0.1$), and has a thickness of 300-2000Å.

24. A nitride semiconductor light emitting device comprising:

a first electrode contact layer;

a first cluster layer formed above the first electrode contact layer;

a first In-containing nitride gallium layer formed above the first cluster layer;

a second cluster layer formed above the first In-containing nitride gallium layer;

an active layer formed above the second cluster layer; and

a p-type nitride semiconductor layer formed above the active layer.

25. The device according to claim 24, wherein the first and/or second cluster layers are/is formed of SiN_a.

26. The device according to claim 24, wherein the active layer comprises:

a first quantum well layer having an $In_yGa_{1-y}N$ well layer/$In_zGa_{1-z}N$ barrier layer structure;

a second In-containing nitride gallium layer formed above the first quantum well layer; and

a second quantum well layer formed above the second In-containing nitride gallium layer to have a structure of at least one of $In_yGa_{1-y}N$ well layer/$In_zGa_{1-z}N$ barrier layer.

27. The device according to claim 24, further comprising a second electrode contact layer formed above the p-type nitride semiconductor layer.

28. The device according to claim 27, wherein the second electrode contact layer has an In-containing super lattice structure.

29. The device according to claim 24, further comprising a Si-doped In-containing super lattice structure formed above the p-type nitride semiconductor layer.

30. The device according to claim 24, wherein the first electrode contact layer comprises:

an In-doped GaN layer;

an $In_xGa_{1-x}N/In_yGa_{1-y}N$ super lattice structure layer formed above the In-doped GaN layer; and

a Si-In co-doped GaN layer formed above the $In_xGa_{1-x}N/In_yGa_{1-y}N$ super lattice structure layer.

31. The device according to claim 24, wherein the active layer has a single quantum well structure or a multi quantum well structure, which has $In_yGa_{1-y}N$ well layer/$In_zGa_{1-z}N$ barrier layer.

32. The device according to claim 24, wherein the active layer is comprised of the $In_yGa_{1-y}N$ well layer and the $In_zGa_{1-z}N$ barrier layer, and a SiN_a cluster layer interposed therebetween.

33. The device according to claim 24, further comprising a SiN_a cluster layer formed between the active

layer and the p-nitride semiconductor layer.

34. A nitride semiconductor light emitting device comprising:

an n-type first electrode contact layer;

a first SiN_a cluster layer formed above the first electrode contact layer;

a first In-containing nitride gallium layer formed above the first SiN_a cluster layer;

a second SiN_a cluster layer formed above the first In-containing nitride gallium layer;

an active layer formed above the second SiN_a cluster layer, for emitting light;

a p-type nitride gallium layer formed above the active layer; and

an n-type second electrode contact layer formed above the p-type nitride gallium layer.

35. A nitride semiconductor light emitting device comprising:

an n-type first electrode contact layer;

a strain control layer formed over the first electrode contact layer;

an active layer formed over the strain control layer, for emitting light, to have an $In_yGa_{1-y}N$ well layer, a SiN_a cluster layer having a thickness of atomic scale, and an $In_zGa_{1-z}N$ barrier layer;

a p-type nitride gallium layer formed above the active layer; and

an n-type second electrode contact layer formed above the p-type nitride gallium layer.

36. A nitride semiconductor light emitting device comprising:

an n-type first electrode contact layer;

a strain control layer formed over the first electrode contact layer;

an active layer formed above the strain control layer;

a SiN_a cluster layer formed above the active layer;

a p-type nitride semiconductor layer formed above the SiN_a cluster layer; and

an n-type second electrode contact layer formed above the p-type nitride semiconductor layer.

37. A nitride semiconductor light emitting device comprising:

an n-type first electrode contact layer;

a strain control layer formed above the first electrode contact layer;

an active layer formed above the strain control layer to have a first quantum well layer, a second quantum well layer, and an $In_xGa_{1-x}N$ layer interposed between the first quantum well layer and the second quantum well layer;

a p-type nitride semiconductor layer formed above the active layer; and

an n-type second electrode contact layer formed above the p-type nitride semiconductor layer.

38. A nitride semiconductor light emitting device comprising:

an n-type first electrode contact layer;

an active layer formed above the first electrode contact layer, for emitting light;

a p-type nitride semiconductor layer formed above the active layer; and

an n-type second electrode contact layer formed above the p-type nitride semiconductor layer to have an $In_xGa_{1-x}N/In_yGa_{1-y}N$ super lattice structure.